EPA Renewable Energy Siting Tool Analysis

A brief guide of analysis and priority ranking

Utility-scale Photovoltaics

Utility-scale Photovoltaics (PV) resource was determined through overlay analysis of a satellite modeled 10kmx10km resolution 1-Axis Tracking layer represented in kWh/m2/day[1]. Capacity potential was estimated using a power density of 48 megawatts (MW)/square kilometer (km2). Generation was estimated using capacity factors calculated using Typical Meteorological Year[2] weather files and PVWatts[3] simulations using typical utility-scale PV ratings.

Concentrating Solar Power

Concentrating solar power (csp) resource was estimated through overlay analysis of a satellite modeled 10kmx10km resolution direct normal insolation (DNI) layer[4]. Only sites with a DNI greater than or equal to 5 kWh/m2/day were further analyzed. Technical capacity potential was estimated assuming a power density of 32MW/km2. Generation potential was estimated using capacity factor bins based on DNI resource, seen in table 1.

Table 1. Capacity Factors for Concentrating Solar Power

kWh/m2/day	Capacity Factor
5-6.25	31.5%
6.25-7.25	38.3%
7.25-7.5	42.8%
7.5-7.75	43.4%
>7.75	44.8%

Wind

Wind power class was determined by overlay analysis with a 50meter hub-height wind power class composite layer[5]. Only sites with a wind power class greater than or equal to 4 were further analysed. Technical capacity potential was estimated using a power density of 5MW/km2. Energy generation was calculated using capacity factors associated with wind power classes (Table 2).

Table 2. Capacity Factors for Wind

Wind Power Class	Capacity Factor
4	36%
5	41%
6	44%

[1] http://www.nrel.gov/gis/data_solar.html
[2] http://rredc.nrel.gov/solar/old_data/nsrdb/
[3] http://www.nrel.gov/rredc/pvwatts/
[4] http://www.nrel.gov/gis/data_solar.html
[5] http://www.nrel.gov/gis/data_wind.html).

7	46%

Geothermal

Hydrothermal capacity potential is derived from a power density layer developed by Williams et al. (2008)[6], who used logistic regression models to determine potential. Generation was estimated using a capacity factor of 90%.

Hydropower

Hydropower technical capacity potential was calculated using hydropower source points from Idaho National Laboratory's report, Feasibility Assessment of the Water Energy Resources of the United States for New Low Power and Small Hydro Classes of Hydroelectric Plants[7]. To determine the total potential capacity, hydropower source points within 1 mile of a contaminated site where aggregated (Figure 1). To estimate generation, a capacity factor of 50% was used.

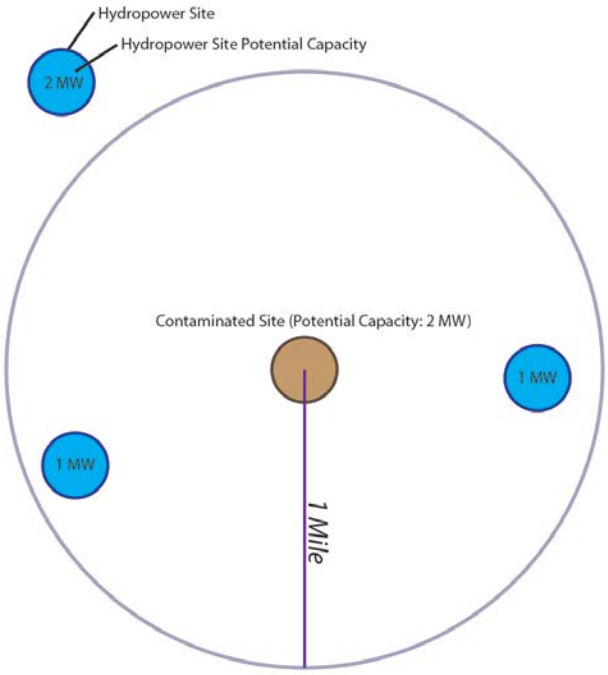

Figure 1. Determining Hydropower Capacity Potential.

[6] Williams, C.F.; Reed, M.J.; Mariner, R.H., DeAngelo, J.; Galanis, S.P., Jr. (2008). "Assessment of Moderate- and High-Temperature Geothermal Resources of the United States." U.S. Geological Survey Fact Sheet 2008-3082. Menlo Park, CA: U.S. Geological Survey.

[7]http://hydropower.inl.gov/resourceassessment/pdfs/main_report_appendix_a_final.pdf).

Priority Sites

Priority sites were determined using the screening criteria listed below in Table 3. These sites are specific for utility-scale renewable energy systems, thus a site could be a priority site for smaller systems with different goals.

Table 3. Priority Rankings

Technology	Distance to Transmission Line (miles) 4-800kv	Distance to Road (miles)	Site Acre	Resource	Ranking
CSP	<=1	<=1	>=400	>=7.5kWh/m2/day	High
CSP	1-2	1-2	250-400	6.5-7.5	Medium
CSP	>2	>2	<250	<6.5	Low
Utility-scale PV	<=1	<=1	>=200	>7kWh/m2/day	High
Utility-scale PV	1-2	1-2	50-200	5-7	Medium
Utility-scale PV	>2	>2	<50	<5	Low
Wind	<=1	<1	>=500	>6 wpc	High
Wind	1-10	1-3	100-500	4-5	Medium
Wind	>10	>3	<100	<4	Low
Hydrothermal	<=1	<=1	>=50	>=15.9kW/km2	High
Hydrothermal	1-10	1-3	10-50	2.73-15.9	Medium
Hydrothermal	>10	>3	<10	<2.73	Low
Hydropower	NA	NA	>= 10	>= 1MW w/in 1 mile of contaminated site	High
Hydropower	NA	NA	NA	NA	Medium
Hydropower	NA	NA	< 10	< 1 MW w/in 1 mile of contaminated site	Low

Slope

Slope was not considered in the screening criteria due to the high fluctuation of slope on very large sites. Slope information is listed in the site database and can be used for further analysis of potential sites.